AF/1723

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

In re the Application of:	]
HERVE LESCUYER et al	]]Attorney Docket: 01115]
Serial No: 09/856,460	]]Group Art Unit: 1723]
Filed: August 7, 2001	]Examiner: K. S. Menon]
For: IMPROVED METHOD FOR FILTERING A METAL LIQUID ON A BED OF REFRACTORY PARTICULATE MATERIAL	]MAIL STOP APPEAL BRIEF-]PATENTS]

Appeal No:_________

Commissioner for Patents
PO Box 1450
Alexandria, VA 22313-1450

SUBMISSION OF APPELLANTS' BRIEF ON APPEAL

Submitted herewith are three copies of Appellants' Brief on Appeal in the above-identified application, together with the required fee, paid by credit card (Form PTO-2038).

Respectfully submitted,

Ira J. Schultz
Registration No. 28666

LAW OFFICES
DENNISON, SCHULTZ, DOUGHERTY & MACDONALD
SUITE 105
1727 KING STREET
ALEXANDRIA, VIRGINIA 22314-2700
703 837-9600

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

In re the Application of:	]
HERVE LESCUYER et al	] Attorney Docket: 01115
Serial No: 09/856,460	] Group Art Unit: 1723
Filed: August 7, 2001	] Examiner: K. S. Menon
For: IMPROVED METHOD FOR FILTERING A METAL LIQUID ON A BED OF REFRACTORY PARTICULATE MATERIAL	] MAIL STOP APPEAL BRIEF-PATENTS

Appeal No:_________

Commissioner for Patents
PO Box 1450
Alexandria, VA 22313-1450

APPELLANTS' BRIEF ON APPEAL

I. REAL PARTY IN INTEREST

The real parties in interest are the assignees, Aluminium Pechiney and Pechiney Rhenalu, and parent company Pechiney (ALCAN Group).

II. RELATED APPEALS AND INTERFERENCES

There are no related appeals or interferences.

III. STATUS OF CLAIMS

Claims 1-9 and 11 are in this application; claim 10 has been canceled.

Claims 1-9 and 11 stand rejected.

IV. STATUS OF AMENDMENTS

There are no unentered amendments.

LAW OFFICES
DENNISON, SCHULTZ, DOUGHERTY & MACDONALD
SUITE 105
1727 KING STREET
ALEXANDRIA, VIRGINIA 22314-2700
703 837-9600

V. SUMMARY OF INVENTION

The invention is directed to a method for filtration of liquid metal comprising passing the liquid metal through a bed of refractory particulate material having an open porosity of between 5 and 30% (page 2, lines 12-15).

The porosity of the particulate material is recited as "open" porosity, defined in the specification at page 2, lines 18-21, as the porous volumes of the grains of the bed (surface porosities and internal porosities). The grains of the bed thus have pores which are open to flow of liquid metal, as opposed to hollow grains which might be closed. As further stated at page 2, lines 21-22 of the specification, this porosity is essentially due to pores of a diameter greater than 10 μm (claim 3), and the particle size is generally between 0.2 and 20 mm and the bed has a thickness between 4 and 40 cm (claim 4; page 2, lines 24-25).

The preferred filtration bed of the invention is alumina, particularly electrofused corundum (claim 5; page 3, lines 8-9), and the invention enables superior purification with residence times equivalent to tabular alumina beds with an open porosity generally less than about 3% as a result of pores of size less than about 10 μm, as discussed in the specification on page 2, line 25 through page 3, line 5.

The invention enables consistent removal of inclusions at a rate of at least 95%, and possibly greater than 97% (page 3, lines 20-21), and enables a reduction of residence time in the bed while maintaining a quality level at least equal to, or greater than, other particulate materials (page 3, lines 27-31). The metal flow rate through the bed may be increased while maintaining efficiency of filtration, and the release of inclusions from the bed during surges of the metal

LAW OFFICES
DENNISON, SCHULTZ, DOUGHERTY & MACDONALD
SUITE 105
1727 KING STREET
ALEXANDRIA, VIRGINIA 22314-2700
703 837-9600

flow rate may be limited (page 4, lines 2-6).

The invention thus provides an ability to increase filtration rates while improving the purification rate, and thus can improve productivity, reduce the size of filtration facilities, reduce consumption of filtering medium and reduce costs. Moreover, the use of corundum reduces costs as this filtering material is less expensive than tabular alumina (page 5, lines 14-20), and is easier to recycle (page 5, lines 21-29).

VI. ISSUES

The issues on appeal are:

1) Whether claims 1, 2, 4 and 6 are obvious under 35 USC 103(a) over Hess et al (US 3,172,757) in view of Rieger et al (US 4,690,763).

2) Whether claims 3 and 11 are obvious under 35 USC 103(a) over Hess et al (US 3,172,757) in view of Rieger et al (US 4,690,763) and further in view of Brezny (US 5,322,821).

3) Whether claims 5, 7, 8 and 9 are obvious under 35 USC 103(a) over Hess et al (US 3,172,757) in view of Rieger et al (US 4,690,763) and further in view of Niedhardt et al (US 4,177,235).

VII. GROUPING OF CLAIMS

The claims are to be considered as a single group.

VIII. ARGUMENTS

In the final rejection, claims 1, 2, 4 and 6 stand rejected under 35 USC 103(a) over Hess et al (US 3,172,757) in view of Rieger et al (US 4,690,763).

Hess et al has been cited to show a filtration method for liquid metal in which the liquid metal is passed through a bed of refractory particulate material, with no porosity

LAW OFFICES
DENNISON, SCHULTZ, DOUGHERTY & MACDONALD
SUITE 105
1727 KING STREET
ALEXANDRIA, VIRGINIA 22314-2700
703 837-9600

being disclosed for the refractory particles. Tabular alumina (synthetic corundum) is the preferred material disclosed at column 2, lines 46-47. The disclosure of this reference corresponds generally to the state of the art, according to the present specification. The present specification includes a comparative example, which will be discussed hereinbelow, showing that filtration on a bed of tabular alumina produces inclusion removal inferior to the removal according to the claimed invention.

The final rejection admits that Hess et al does not disclose the porosity of the particles, but has cited Rieger et al for this purpose. As stated in the final rejection:

"Rieger teaches the porosity of the hollow refractory particles (see col 2 lines 60-63; col 2 lines 34-48). {Rieger teaches the overall density of the filter bed as about 25% of the ceramic material density (col 2 lines 34-35), which means that the overall porosity is about 75%. Overall porosity includes the space between the particles and the pores within the particles. Of this, about 45% is space between the particles (see col 2 lines 40-52, which defines porosity between the spheres as 5-45%). Therefore, the remaining 30% (75% minus 45%) is porosity within the particles.} It would be obvious to one of ordinary skill in the art as taught by Rieger in the teaching of Hess for improved wettability and filter capacity (Rieger: col 2 lines 15-21)."

The final rejection therefore argues that Rieger teaches filtration using particles which have an internal porosity of 30%.

Initially, it is noted that the filtration medium of Rieger is a "stable, porous body of granules of spherical form bonded together by a different phase or by sintering"

LAW OFFICES
DENNISON, SCHULTZ, DOUGHERTY & MACDONALD
SUITE 105
1727 KING STREET
ALEXANDRIA, VIRGINIA 22314-2700
703 837-9600

(see Abstract). Thus, the Final Rejection is attempting to use only the alleged porosity of the granules of Rieger et al, applying this porosity to the granules of Hess et al, while ignoring the fact that Rieger et al teaches a filter material in the form of bonded plate.

Moreover, Appellant submits that the allegation regarding the porosity of the Rieger et al particles was effectively rebutted in the Response filed on July 22, 2003, including the Declaration under 37 CFR 1.132 of Pierre LeBrun.

In the Declaration of Pierre Le Brun, an expert in the field of metallurgy and metal casting, in particular molten metal treatment and filtration, employed by the Assignee, Dr. Le Brun points out that while the apparent or actual measured density of the bed of particles is 25% of theoretical, the actual volume of the particles makes up only 55% of the space in the filter bed. Thus, the proper density calculation for the particles alone is 25 divided by 55, or 45.4% of theoretical density. Hence, the volume of empty space within the particles must be 54.55%, which is far greater than the 30% attributed by the Office action to space within the particles.

Moreover, Dr. Le Brun further concludes that the porosity of the plate intended for filtration by Rieger et al is that of the space *between* the granules and not of the space *within* the granules. It is his opinion that the space within the particles is normally not accessible to the liquid metal for filtration and does not significantly enhance the open porosity of the plate.

Since Rieger et al clearly states that *solid* or *hollow* particles may be used interchangeably (col. 2, lines 60-61),

LAW OFFICES
DENNISON, SCHULTZ, DOUGHERTY & MACDONALD
SUITE 105
1727 KING STREET
ALEXANDRIA, VIRGINIA 22314-2700
703 837-9600

Dr. Le Brun believes that they do not specifically teach the use of hollow spheres to improve filtration properties, but rather to reduce the weight of the plate and improve its strength.

Rieger et al does state that the shells are not obliged to be continuously impervious, and that porosities or points of fracture in the shells, occurring even at random, by subsequent breakdown of granules provided in spherical form can be employed; see col. 2, line 66 through col. 3, line 2.

Thus, the internal porosity of the Rieger et al particles appears to be both greater than the presently claimed porosity and substantially closed porosity which is unlikely to be available for filtration. Certainly, Rieger et al does not teach that this internal porosity *should* be available for filtration, which is the basis for the claimed invention. Rieger et al, rather, teaches that it is the spaces between the particles which are used for filtration, and hollow particles are used to reduce the weight of the filter plate.

Thus, there is nothing in Rieger et al which discloses or suggests that the use of hollow particles enhances filtration of liquid metal, or that such pores should be open to enhance the filtration.

In response to the Declaration of Dr. LeBrun as discussed above, the Final Rejection states:

"The examiner agrees that Dr. LeBrun is correct in his calculation of the porosity of the granules (within the granules). However, Dr. LeBrun also explains that most of this porosity within the granules is possibly from closed voids, ie, voids that are unavailable for the molten metal for filtration. If one reads the example described in the

LAW OFFICES
DENNISON, SCHULTZ, DOUGHERTY & MACDONALD
SUITE 105
1727 KING STREET
ALEXANDRIA, VIRGINIA 22314-2700
703 837-9600

Rieger ref, col 7 lines 30-49, 82% is the total void volume of the bed, of which only 55% is available for aluminum, the molten metal filtered. Therefore, in the same line of argument as that of Dr. LeBrun, the actual volume available within the particles of the bed for filtering is much less than 55%. If the void volume of the bed between the granules is maintained at 45% by design by Rieger, the contribution of the void volume in the bed that comes from within the granules would be 10% (the open porosity of the granules would be a bit higher than 10% as shown by Dr. Le Brun's calculations), which would overlap the range of the claimed invention. Also please note that Rieger teaches to use apparent density of 16-25% when using the hollow spheres (col 6 lines 27-30). Re Dr. Le Brun's opinion that Rieger does not teach the inner porosity of the particles to improve filtration but only to reduce the weight of the plate because Rieger teaches using hollow and solid particles interchangeably: first of all, Rieger teaches hollow particles as preferable (col 2 lines 60-65) and uses hollow spheres in the example; and secondly, Rieger teaches that the filter media of his teaching affords better efficiency, high capacity and easy to use (col 2 lines 15-21). It may be noted that the motivation to combine the references need not be what the applicant has recognized as the advantage. The fact that applicant has recognized another advantage which would flow naturally from following the suggestion of the prior art cannot be the basis for patentability when the differences would otherwise be obvious. See *Ex parte Obiaya*, 227 USPQ 58, 60 (Bd. Pat. App. & Inter. 1985)."

To respond to these allegations, Appellant submitted a further Declaration under 37 CFR 1.132 from Dr. LeBrun with

LAW OFFICES
DENNISON, SCHULTZ, DOUGHERTY & MACDONALD
SUITE 105
1727 KING STREET
ALEXANDRIA, VIRGINIA 22314-2700
703 837-9600

the response filed on January 30, 2004, analyzing the statement of Rieger et al at column 7, lines 30 through 49.

Dr. Le Brun states that during the 1980's, when the Rieger et al patent was written, one of the main problems with filters for liquid metal was that liquid metal would not flow evenly throughout the entire available space. In other words, some of the available porosity was not penetrated by the liquid metal. Dr. Le Brun believes that the cited paragraph in Rieger et al refers to this phenomenon, and that the 82% figure is a relative figure, specifically the figure being relative to the *available* porosity which can be penetrated by the liquid metal during filtration.

Consequently, Rieger et al does not state that the porosity of the filter is 82%, and it is not possible to determine the total available space using that 82% figure which is only a relative number. Appellants maintain once again that the overall porosity of the filter thus must be held to be 5 to 45% by volume as disclosed at column 2, lines 40 through 48.

It is further noted that the Office action alleges that while Rieger et al does not teach using the inner porosity of the particles as improving filtration, but only for reducing weight, it nevertheless provides motivation to use hollow particles. While Appellants agree that Rieger et al teaches the use of hollow particles, and may provide motivation to use hollow particles, that motivation is limited to the use of substantially closed hollow particles, in which the inner porosity is substantially closed, and is <u>not</u> available for filtration. To the contrary, the claimed invention is specifically directed to the use of particles with <u>open</u> porosity, porosity which is available for filtration. If the

LAW OFFICES
DENNISON, SCHULTZ, DOUGHERTY & MACDONALD
SUITE 105
1727 KING STREET
ALEXANDRIA, VIRGINIA 22314-2700
703 837-9600

porosity is closed and not available for filtration, it does not provide the benefits of the claimed invention.

In the Advisory Action mailed March 11, 2004, the argument is made that the filter material of Rieger et al is similar to that of US Patent No. 4,278,544, which uses solid spheres and which has a porosity of 15-40%, whereas the filter material of Rieger et al uses hollow spheres. The action states "[t]herefore the shell of the spheres would have a similar porosity, ie., in the range of 15-40%." However, with reference to the passage of Rieger et al at col. 1, line 60-col. 2, line 15, this prior art filter material is a sintered alumina plate, containing alumina and binder, with a porosity of 15-40% and a mean pore diameter of 500-1 microns. It is believed that the filtering of this earlier patent is done in the space between the particles, and not in open pores of these particles, just as the filtering of Rieger et al is done in the spaces between the pores and not in the shell of the spheres. Appellants submit that the porosity of 15-40% of the '544 patent and the porosity of 5-45% of Rieger et al is substantially the same porosity, porosity between particles of the sintered filter plate. There is no evidence that either patentee is using open porosity of the particles to assist in the filtration.

The effectiveness of the claimed invention is established by the comparative example on pages 6-9 of the specification. In this comparison, tabular alumina with a porosity of 2.8% and white corundum with a porosity of 10.7% were used to remove inclusions from a liquid aluminum-magnesium alloy. For each size of inclusion, inclusion removal rate was 97-100% for the corundum according to the invention. The removal rate for the tabular alumina was

LAW OFFICES
DENNISON, SCHULTZ, DOUGHERTY & MACDONALD
SUITE 105
1727 KING STREET
ALEXANDRIA, VIRGINIA 22314-2700
703 837-9600

generally much lower, and quite variable.

Figure 2 of the specification shows a comparison of filtering efficiency for the tabular alumina of the prior art (A) and the corundum of the invention (B). The corundum of the invention maintains a high efficiency for residence times from about 20 to 120 seconds. The prior art product starts with much lower efficiency and does not achieve a high efficiency until residence time reaches almost 180 seconds.

The Brezny reference (cited against claims 3 and 11) has been cited to show that it is known to prepare hollow ceramic (alumina) beads in the claimed size range. These beads may have open porosity, but there is no disclosure or suggestion that beads having an open porosity of 5 to 30% are advantageous in filtering molten metal.

Neidhardt et al (cited against claims 5, 7, 8 and 9) has been cited to show the production of electrically fused corundum. Neidhardt et al does not disclose or suggest the use of particles of electrically fused corundum of open porosity of 5 to 30% for filtration of molten metal.

In summary, the claimed invention is unobvious over the cited art because none of the cited references discloses or suggests filtering molten metal with refractory particles having an open porosity of 5 to 30%. Appellants submit that the rejection of record is based upon a misinterpretation of the Rieger et al reference, and that this reference teaches filtration using porosity between the particles in a filter plate. While porosity may be present within the grains, Rieger et al does not disclose or suggest that this porosity is open porosity (in an amount of 5-30%) and the calculations presented in the Declarations of Pierre LeBrun rebut the allegations that such open porosity is taught by Rieger et al.

LAW OFFICES
DENNISON, SCHULTZ, DOUGHERTY & MACDONALD
SUITE 105
1727 KING STREET
ALEXANDRIA, VIRGINIA 22314-2700
703 837-9600

Reversal of the rejections of record is respectfully requested.

Respectfully submitted,

Ira J. Schultz
Registration No. 28666

LAW OFFICES
DENNISON, SCHULTZ, DOUGHERTY & MACDONALD
SUITE 105
1727 KING STREET
ALEXANDRIA, VIRGINIA 22314-2700
703 837-9600

IX. APPENDIX

The claims on appeal:

1. A filtration method for liquid metal comprising passing said liquid metal through a bed of refractory particulate material formed from grains having an open porosity between 5 and 30%.

2. The filtration method according to claim 1, wherein the liquid metal has a residence time in the particulate material bed greater than 1 sec and less than 500 secs.

3. The filtration method according to claim 1, wherein the porosity substantially stems from pores with a diameter greater than 10 µm.

4. The filtration method according to claim 1, wherein the material has a particle size between 0.2 and 20 mm and the bed has a thickness between 4 and 40 cm.

5. The filtration method according to claim 1, wherein the material is electrofused corundum.

6. The filtration method according to claim 1, wherein the liquid metal is selected from the group consisting of aluminum, magnesium and alloys thereof.

7. The filtration method according to claim 5, wherein the corundum is obtained by method steps comprising electrofusion of alumina, a casting, a cooling and solidification in order to obtain said porosity, a crushing, then a screening process.

8. A corundum used in the method according to claim 5, having a porosity between 5 and 30%.

9. A filtration device for liquid metal including the corundum according to claim 8.

11. The filtration method according to claim 3, wherein the porosity substantially stems from pores with a diameter between 10 and 200 µm.

LAW OFFICES
DENNISON, SCHULTZ, DOUGHERTY & MACDONALD
SUITE 105
1727 KING STREET
ALEXANDRIA, VIRGINIA 22314-2700
703 837-9600